Artificial Intelligence: Status and Opportunities

Kerstin Kleese van Dam
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Identifying these are Dogs is Machine Learning
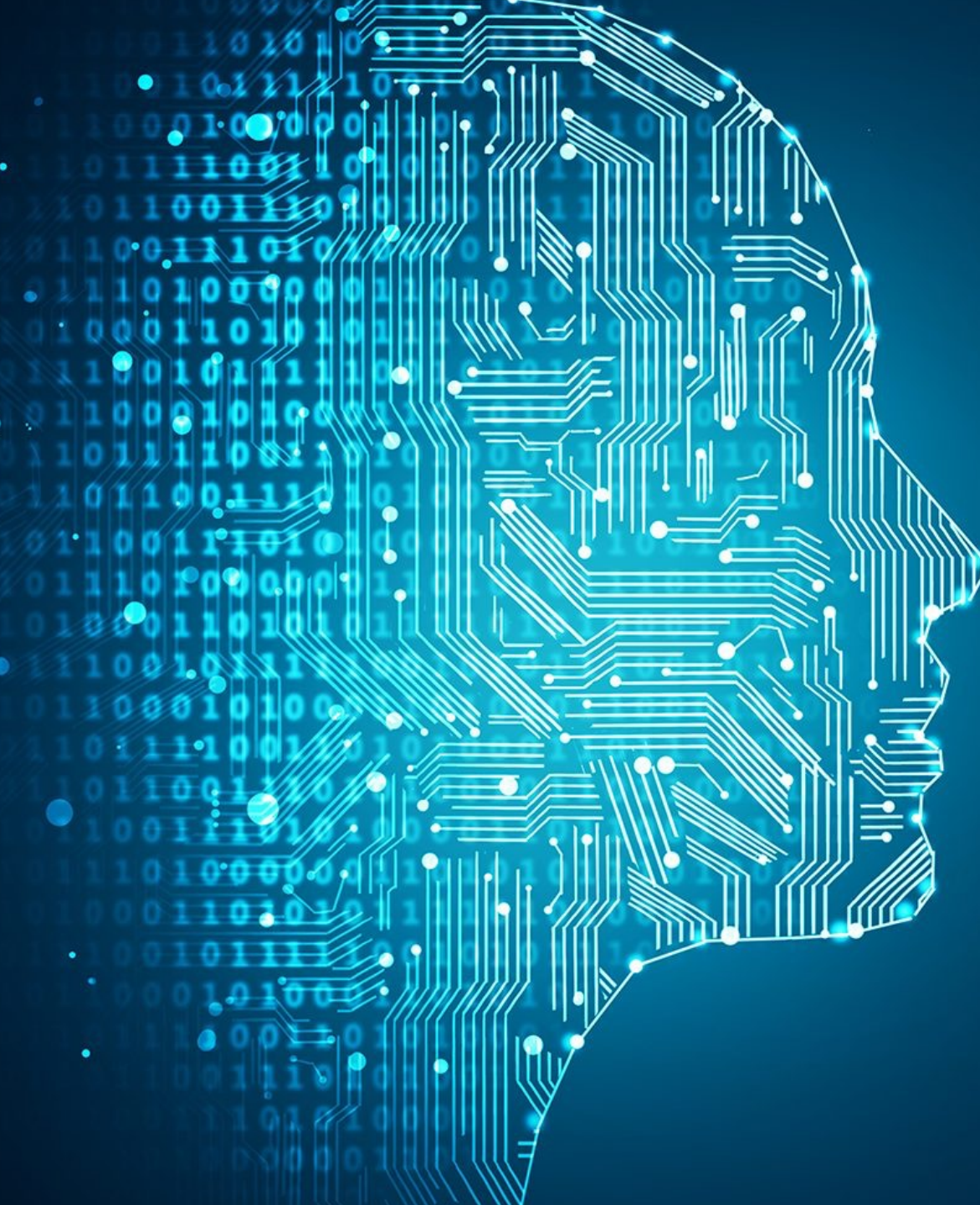
Autonomously driving this Car is AI

Why is Everyone talking about AI Today?

- **AI has been around for a long time, in 1951 a machine called Ferranti Mark 1 used the algorithm to master Checkers.**

- **Big Data - Drives demand for AI, but is also the lifeblood of modern AI technologies**

- **Big Machines - Training a good algorithm used to take a very long time, new hardware and bigger systems, make it now a question of hours.**
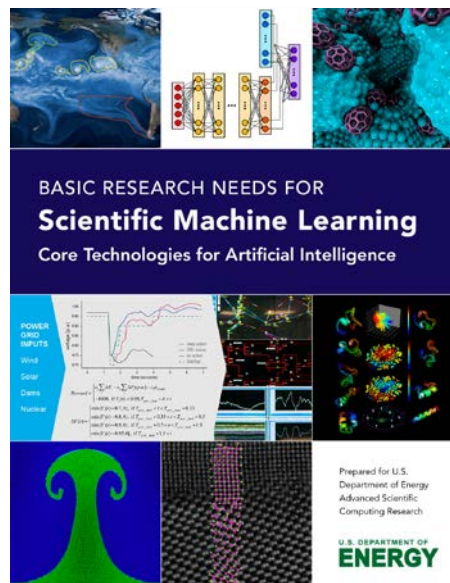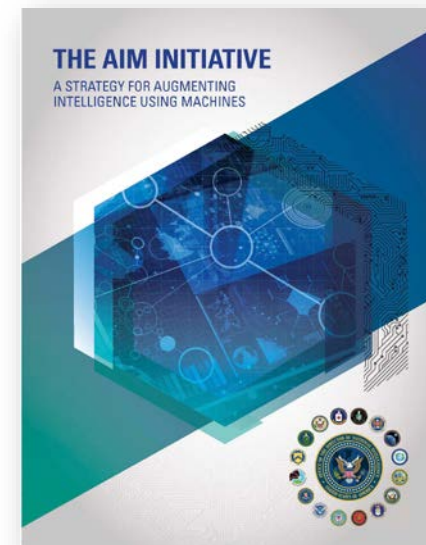
National Activities

Setting the Stage for Artificial Intelligence Research Priorities

https://www.federalregister.gov/d/2019-02544

DOI: 10.2172/1478744

https://www.dni.gov/files/ODNI/documents/AIM-Strategy.pdf

Feb 2019 - Executive Order Issued

Defined in *Maintaining American Leadership in Artificial Intelligence*

- <u>Sec</u>. <u>9</u>. <u>Definitions</u>. As used in this order:

(a) the term "artificial intelligence" means the full extent of Federal investments in AI, to include: R&D of core AI techniques and technologies; AI prototype systems; application and adaptation of AI techniques; architectural and systems support for AI; and cyberinfrastructure, data sets, and standards for AI; and…

From: Exec. Order No. 13859, 84 Fed. Reg. 3967 (Feb. 14, 2019).
https://www.federalregister.gov/d/2019-02544

U.S. DEPARTMENT OF **ENERGY**

BROOKHAVEN
NATIONAL LABORATORY

Sep 2019 - DOE Artificial Intelligence and Technology Office Established

Vision:

Transform DOE into a world-leading AI enterprise by accelerating the research, development, delivery, and adoption of AI.

Mission:

.."accelerate the delivery of AI-enabled capabilities, scale the department-wide development and impact of AI, and synchronize AI activities"..

Innovation*X*lab Summits

The [Office of Technology Transitions](#) (OTT) designed the Innovation*X*Lab series to expand the **commercial impact** of the National Labs.
Innovation*X*Lab summits facilitate a two-way exchange between industry, universities, manufacturers, investors, and end-use customers with innovators and experts from across the National Labs and broader DOE R&D complex.

BNL Team at AI Innovation*X*lab

- 1 1/2 Days of Talks, Panel Discussion and Speed Dating with Industry

- Doon Gibbs, Martin Schoonen, Frank Alexander, Diana Murphy, Poornima Upadhya, Kerstin Kleese van Dam

- Promising Contacts with Industry

DOE AI Town Halls

- Defining the AI Research Agenda for the coming 10 year

- ANL July 22-23

- ORNL Aug 20-21

- LBNL Sep 11-12

- DC Oct 22-23

- ~1300 attendees overall

- Initial Outcome Summary https://science.osti.gov/-/media/ber/berac/pdf/201910/Helland_BERAC_Oct2019.pdf?la=en&hash=D9459B813821252BDABA27F6E48D467B20159A7E

BNL at AI Town Halls

- BNL staff were present at all four meetings and contributed to the workshop report.

- Thorough requirements definition in fields of interest to BNL - Accelerators, HEP, NP, Biology, Imaging, etc.

AI Town Hall - Identified Research Themes

- AI Revolution
  - Learned Models Replace Data
  - Experimental Discovery Refactored
  - Questions Pursued Semi-Autonomously
  - Simulation and AI Merge
  - Theory Becomes Data
  - AI Laboratories

Next Steps at DOE

- Work with other Program Offices to build a coordinated SC AI research program similar to our Quantum program

- As a first step, on Tuesday, SC Director Fall announced forthcoming charge to ASCAC

  - to establish a subcommittee to look at the outputs from the several workshops and subcommittee reports

  - analyze the opportunities and challenges for ASCR and the Office of Science associated with Artificial Intelligence and Machine Learning.

What are we doing at BNL

- Significant Portfolio of AI Research at BNL:
  - CSI Fundamental AI research & collaborative application development
  - Efforts across the lab in ML/AI development and application - NSLS II, CFN, Chemistry, Biology, Cosmology, Atlas …
  - Evaluating new AI specific hardware solutions
  - Scientific Data and Computing Center offers 2 new AI Cluster for BNL use

BNL is Developing the AI Strategy

- Frank Alexander is coordinating efforts to develop a BNL wide AI strategy

  - What are cross cutting themes?

  - Where can BNL lead?

  - What are our unique strength?

- Build community of practice

- Next CSI to offer AI hackathons - help to choose the right AI methods, and optimize its implementation

We are only at the beginning of exploring what AI can do for us. There are many possible applications, but we must proceed with care, being aware of the limitations and pitfalls.